INFLUENCE OF A PERPETRATOR'S DISTINCTIVE FACIAL FEATURE ON EYEWITNESS IDENTIFICATION FROM SIMULTANEOUS VERSUS SEQUENTIAL LINEUPS

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This study featured a multiple-block face recognition paradigm. For each of several blocks, participants studied a sequential presentation of briefly-presented faces that included a target, and then later in the same block they made an identification decision from either a simultaneous or sequential lineup. Targets had been rated for distinctiveness and then a distinctive feature (scar, mole, or black eye) had been added (or not) to assess a potential interaction between holistic and feature-driven distinctiveness in terms of correct identification rate (target choices) and false identification rate (non-target "innocent suspect" choices). Distinctive faces yielded higher accuracy overall, replicating prior research. Adding a feature to a nondistinctive target did not change correct identification rate; interestingly, adding a feature to a distinctive target *decreased* correct identification rate, but only for simultaneous lineups. Out of four simultaneous-sequential comparisons, there was one sequential lineup advantage (lower false identification rate): after encoding a nondistinctive target with an added feature. Overall, results from this single experiment suggest that if an eyewitness's description of a perpetrator includes a distinctive feature, a sequential lineup should be used to protect the innocent. However, if no distinctive feature is mentioned, there is no preference for simultaneous or sequential lineup.

Keywords: eyewitness identification, distinctiveness, simultaneous and sequential lineups, distinctive feature

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Imagine that you are at your local convenience store and witness the cashier getting robbed. The perpetrator does not bother with a mask, but you notice that he has a black eye, apparently recently having been involved in a fight. Will the presence of this black eye, or some other distinctive facial feature (e.g., a scar, a large mole), help, harm, or have no effect on your ability to identify this person in a police lineup, assuming he still has this feature at that time? What if the perpetrator just strikes you as looking strange, in a more

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holistic sense? Some people are easier to recognize than others (Shapiro & Penrod, 1986), and it is not always easy to identify a single feature that explains this. The influence of, and potential interaction between, feature-driven and holistic distinctiveness of a target on later lineup identification is the focus of this study.

THE PROBLEM OF EYEWITNESS IDENTIFICATION AND IMPORTANT VARIABLES FOR RESEARCH

Mistaken eyewitness identification is a major problem in the realm of criminal justice. As of November 9th, 2011, 278 individuals in the U.S. had been released from prison based on DNA exoneration. Mistaken eyewitness identification was involved, at least in part, in approximately 75% of these cases (Brewer & Wells, 2011). This problem has led to decades of empirical research by psychological scientists (Wells & Olson, 2003). Wells (1978) categorized eyewitness identification-related variables into two categories for researchers: estimator and system variables. Estimator variables are those that cannot be affected by those in the criminal justice system. Examples include the amount of light at the time of the crime, the eyesight of the eyewitness(es), and whether or not the perpetrator wore a mask. Due to the fact that these variables only can be estimated after the fact, most researchers have conducted experiments on system variables, such as instructions provided to the eyewitness before a lineup and the type of lineup presented (Lindsay & Wells, 1985; Malpass & Devine, 1981).

Perpetrator Distinctiveness is a Potentially Important Estimator Variable

The lack of attention paid to estimator variables is unfortunate because of extensive research conducted on these factors in the basic empirical literature. For example, research on the influence of face typicality (i.e., distinctiveness) on memory has shown that correct identifications are higher for distinctive faces (Courtois & Mueller, 1981), false alarms are lower for distinctive faces (Bartlett, Hurry, & Thorley, 1984), and recollection (relative to familiarity) is associated with distinctive faces (Brandt, Macrae, Schloerscheidt, & Milne, 2003). Important insight could be garnered by generalizing these effects to eyewitness identification.

The estimator variable of interest in this study is the presence of a distinctive feature on a target's face, which is a particularly important variable because of the ease with which a criminal could add an artificial feature. Cutler, Penrod, and Martens (1987) examined the effect of disguise on eyewitness identification, finding that identification accuracy was significantly lower after their perpetrator wore a hat covering his hair compared to a no-hat condition. Also, Shapiro and Penrod (1986), in a meta-analysis of 128 eyewitness identification and facial recognition studies, showed that a disguise reduced identification accuracy significantly. Would adding a distinctive feature to the face similarly harm accuracy, or might it be enhanced? Both Cutler et al. (1987) and the disguise studies included in the Shapiro and Penrod (1986) meta-analysis involved a change in appearance in the perpetrator between the time of the crime and the lineup. In the present study, the distinctive feature was kept constant across these two events based on recent research by Zarkadi, Wade, and Stewart (2009) that found that eyewitness identification is improved if a distinctive feature is replicated across lineup members rather than eliminated. This could be due in part to the fact that a change in appearance between crime and lineup has such deleterious effects.

In the present study, facial distinctiveness and distinctive facial features were operationalized as in Knapp, Nosofsky, and Busey (2006): a distinctive face is “one that is relatively isolated in the multidimensional similarity space of studied exemplars” (p. 877), and a distinctive feature is a “highly salient specific feature” (p. 878). They pointed out that these two can be confounded, such that a salient facial feature could force a face into an isolated part of the space. In the present study, faces first were rated for distinctiveness, therefore establishing their likely level of relative isolation in the multidimensional space of the participants’ stored exemplars, and these were presented either with or without a distinctive facial feature.

A paucity of research on facial distinctiveness exists in the eyewitness identification literature. For example, Courtois and Mueller (1981) assessed the influence of rated distinctiveness of targets and foils in several lineups, but they focused exclusively on target-present simultaneous lineups and did not manipulate the presence of distinctive features. Gronlund (2005) proposed that the advantage of the sequential over the simultaneous lineup might be attributed, at least in part, to the recollection of distinctive information about the target. Carlson and Gronlund (2011) followed this up by comparing faces rated as distinctive versus nondistinctive while comparing simultaneous and sequential lineups. They replicated in an eyewitness identification paradigm the findings typical in the basic literature of higher correct identification rate and lower false identification rate for distinctive faces. They also found a sequential lineup advantage only for distinctive faces. The present study continues in this vein, and describes the importance of comparing simultaneous and sequential lineups.

Lineup Presentation is an Important System Variable

The literature is inconsistent regarding whether a simultaneous or a sequential lineup is preferable. A simultaneous lineup, in which all lineup members are presented at once, has historically been most common. However, Lindsay and Wells (1985) found that presenting members sequentially, not allowing participants to know how many individuals are in the lineup, not presenting additional members after a selection has been made, and not allowing passed faces to be viewed again, combined to reduce the false identification rate of an innocent suspect. Subsequent research has been mixed regarding this sequential superiority effect, with several older studies finding it (Lindsay, Lea, & Fulford, 1991; Lindsay et al., 1991; Lindsay, Pozzulo, Craig, Lee, & Corber, 1997; Melara, DeWitt-Rickards, & O’Brien, 1989), but some newer ones not finding it (Carlson & Gronlund, 2011; Carlson, Gronlund, & Clark, 2008; Gronlund, Carlson, Dailey, & Goodsell, 2009; Meissner, Tredoux, Parker, & MacLin, 2005). Therefore lineup type in the present study was manipulated to assess its robustness across the distinctiveness manipulations.

In addition, Lindsay, Mansour, Beaudry, Leach, and Bertrand (2009) stated the need for more tests of the influence of a good memory for the target on eyewitness identification. A distinctive target is more memorable than a nondistinctive target, therefore the present research addressed this need to a certain extent. It expanded the finding by Carlson and Gronlund (2011) that the sequential lineup advantage occurred only for distinctive targets. They used faces rated as holistically distinctive or nondistinctive without assessing the presence of distinctive features. Here this study focuses on both elements of facial distinctiveness.

The Present Research

This study addressed the following questions. First, what is the influence of a target's distinctive facial feature on eyewitness identification accuracy in terms of correct identification, false identification, and probative value? Does the presence of a distinctive facial feature interact with holistic distinctiveness of a target's face? Will feature-driven, holistic, or some combination of distinctiveness predict the likelihood of a sequential lineup advantage? Following Carlson and Gronlund (2011), the sequential lineup advantage should occur only after encoding a distinctive target. However, this could occur for distinctive targets with or without an added feature, or nondistinctive targets with an added feature. As described below, this study found evidence for the latter, which has implications for police. The determination of whether or not a perpetrator had a distinctive facial feature should not be difficult, as such a characteristic likely would be part of an eyewitness' description (Wells, 1985). Perhaps it is only in this case that a sequential lineup is preferable, and police would be able to expect this in advance of the lineup.

The following terms will be used throughout the paper. In the lineup recognition paradigm, each lineup contains either a *target* for target-present (TP) lineups, or an *innocent replacement* (IR) for target-absent (TA) lineups. The target is previously encoded, and the IR is novel along with the lineup foils. Both foils and the IR match a modal description of the target, but the IR also was rated as looking more like the target than the foils. *Correct ID rate* is the likelihood of selecting the target from a TP lineup; *false ID rate* is the likelihood of choosing the IR from a TA lineup. These rates combine in a simple formula to calculate a measure of *probative value* (Clark, Howell, & Davey, 2008), defined as P(T|TP)/[(P(T|TP) + P(IR|TA)], where P(T|TP) equals the probability that the target was chosen from a TP lineup and P(IR|TA) equals the probability that the IR was chosen from a TA lineup. This probability addresses the question, "how likely was it that the *target* was chosen given a suspect choice from the lineup?" This is the key question faced by police and jurors in the real world.

METHOD

Participants

One hundred undergraduates (mean age 21; 34 males) of a Midwestern university participated in the present experiment for course credit.

Materials/Stimuli

The following stimuli were used: (a) a set of distinctive and nondistinctive faces based on distinctiveness ratings after obvious distinctive features were removed, and (b) fair lineups composed entirely of distinctive or entirely of nondistinctive faces. These stimuli were established and used by Carlson and Gronlund (2011, Appendix). A research assistant then applied a feature to each target, IR, and foils, using Adobe Photoshop. One-third of faces were randomly assigned to receive a black eye (always the right eye), one-third were given a scar vertically across part of the right eye, and one-third were given a large mole on their left cheek, to the lower-left of the eye (Figure 1). As a manipulation check to confirm that adding a feature made the overall set of faces more distinctive, 19 participants provided distinctiveness ratings (1-7 Likert scale) for each face individually. Each face was presented twice, once with feature and once without, and all were presented in a random order. As expected, the distinctiveness of the original faces ($M = 3.29$, $SD = 0.65$) was increased ($M = 4.46$, $SD = 0.67$) by adding a feature, $t(77) = 15.35$, $p < .001$, Cohen's $d = 1.77$.

Figure 1. Examples of target faces with an added distinctive feature (from left to right: black eye, scar, and mole).

Each lineup contained a target (or IR) and five foils, and for those lineups in the feature condition, all members had the same feature (i.e., only one of the three added features was present in a given lineup), based on the findings and recommendation by Zarkadi et al. (2009) that police should replicate, rather than conceal, a distinctive feature across lineup members. Twelve lineups contained unmodified faces, and the same 12 contained the same faces with one of the three distinctive features added to all lineup members. Each set of 12 broke down as follows: (a) three TP lineups with distinctive faces, (b) three TP lineups with nondistinctive faces, (c) three TA lineups with distinctive faces, and (d) three TA lineups with nondistinctive faces. Either five or seven (counterbalanced) of these 12 targets and associated lineups had a distinctive feature, and all three features (black eye, mole, scar) were represented at least once for each participant. There was no difference for any dependent variable based on feature type, therefore they will not be mentioned again. Finally, the order of the 12 target-lineup pairs was randomized for each participant.

Procedure

Participants, either individually or in groups of two to four, each sat in a cubicle with desk and computer. After informed consent, they read the instructions for the experiment on a computer screen while a research assistant read them aloud. Each participant took part in 12 randomized trials, each of which contained an encoding, filler, and lineup phase, based on the procedure from Carlson & Gronlund (2011) (Figure 2). During the encoding phase of each trial, several distractor faces and houses were presented sequentially in the center of the screen for 500 milliseconds (ms) each with a green background. These faces were those deemed nondistinctive and without obvious distinctive features drawn from a set of Caucasian men between the ages of 20 and 40 from the Florida Department of Correction inmate database, and none were ever placed in a lineup. After 8-12 (randomly determined for each trial) of these stimuli, the target appeared in the center of the screen with a red background for one second. It was followed by 8-12 additional stimuli (distractor faces and houses presented in random order). Participants were instructed prior to each trial to pay attention to all of these faces, but to pay particular attention to the face with the red background.

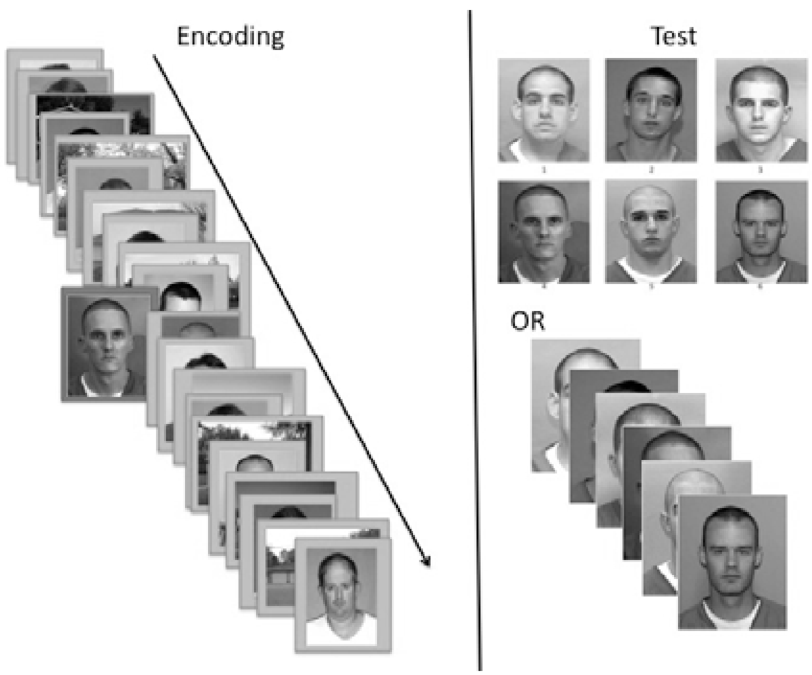

Figure 2. Outline of the experimental procedure for each of the 12 trials: a target was presented on a red background (offset in the figure) for 1000 ms amidst house and face distractors, each of which was presented on a green background for 500 ms. After a yes/no recognition test of the distractor faces (not depicted), either a simultaneous or sequential lineup was presented that contained the target or an innocent replacement. Images of faces are reproduced with permission from the Florida Department of Corrections.

An old/new recognition test for the faces with a green background (in random order with several novel faces) followed the encoding phase of each trial, to serve as a five minute filler before the test and to mimic the real world case of interfering visual objects encountered between a crime and lineup. Either a TP or TA lineup followed (each participant saw six of each type in random order), which was either presented simultaneously or sequentially (between-participants). The participants' goal was to determine whether or not the face presented with the red background earlier in that trial was present in the lineup. They were instructed that the target may or may not be present, and they could either choose a lineup member or reject the lineup. For the simultaneous lineup (presented as one row of three labeled 1-3 from left to right just above another row of three labeled 4-6), participants entered the number corresponding with the member they wanted to choose, or "n" for "none of the above." For the sequential lineup (also containing six members), they could enter "y" or "n" for each face. The lineup continued regardless of the response, but participants were told that only their first "y" response counted (and this was true). After the lineup, instructions were presented on the screen to prepare the participant for the automatic start of the encoding phase of the next trial. The E-prime 2.0 program presented all stimuli and recorded responses (Schneider, Eschman, & Zuccolotto, 2002).

Design. This experiment featured a 2 (simultaneous or sequential lineups, between-participants) x 2 (distinctive or nondistinctive target, within-participants) x 2 (feature added to face or not, within participants) x 2 (TA or TP lineup, within-participants) mixed design. The typical eyewitness memory paradigm utilizes TA and TP lineups, which is important because overall eyewitness accuracy is derived from a different dependent variable from each lineup type; namely, false identification rate (choices of the innocent suspect from TA lineups) and correct identification rate (choices of the target from TP lineups), respectively.

RESULTS AND DISCUSSION

Mixed factorial analyses of variance and *t*-tests with Bonferroni correction were used to analyze the data. All reported *p*-values are two-tailed. The results will be covered in the following order: correct ID rate, false ID rate, and probative value.

Participants correctly identified distinctive more often than nondistinctive faces, $F(1, 98) = 3.87$, $p = .04$, $\eta_p^2 = .05$, but they correctly identified faces with an added feature less than those without, $F(1, 98) = 6.66$, $p = .01$, $\eta_p^2 = .06$. However, these main effects should be interpreted in light of the three-way interaction (there were no two-way interactions) between holistic distinctiveness, the presence of an added feature, and simultaneous versus sequential lineup. Figure 3 depicts this interaction by dividing the data by target distinctiveness. All means fall between .70 and .80 except for two: high correct ID rate of .92 for distinctive targets without an added feature presented in simultaneous lineups, and low correct ID rate of .59 for nondistinctive targets with an added feature presented in sequential lineups. The correct ID rate of .59 did not differ significantly from any of the other means from Figure 3, but .92 was significantly higher than: (a) distinctive faces with an added feature, $t(48) = 3.15$, $p = .003$, $d = 0.63$; and (b) nondistinctive faces without an added feature, $t(48) = 3.06$, $p = .004$, $d = 0.51$. All-in-all, these results reveal three things:

(a) sequential lineup correct ID rate was not affected by either distinctiveness or an added feature, (b) distinctive targets presented in simultaneous lineups yielded the highest correct ID rate, and (c) adding a feature to an already-distinctive target reduced the correct ID rate, but only for the simultaneous lineup.

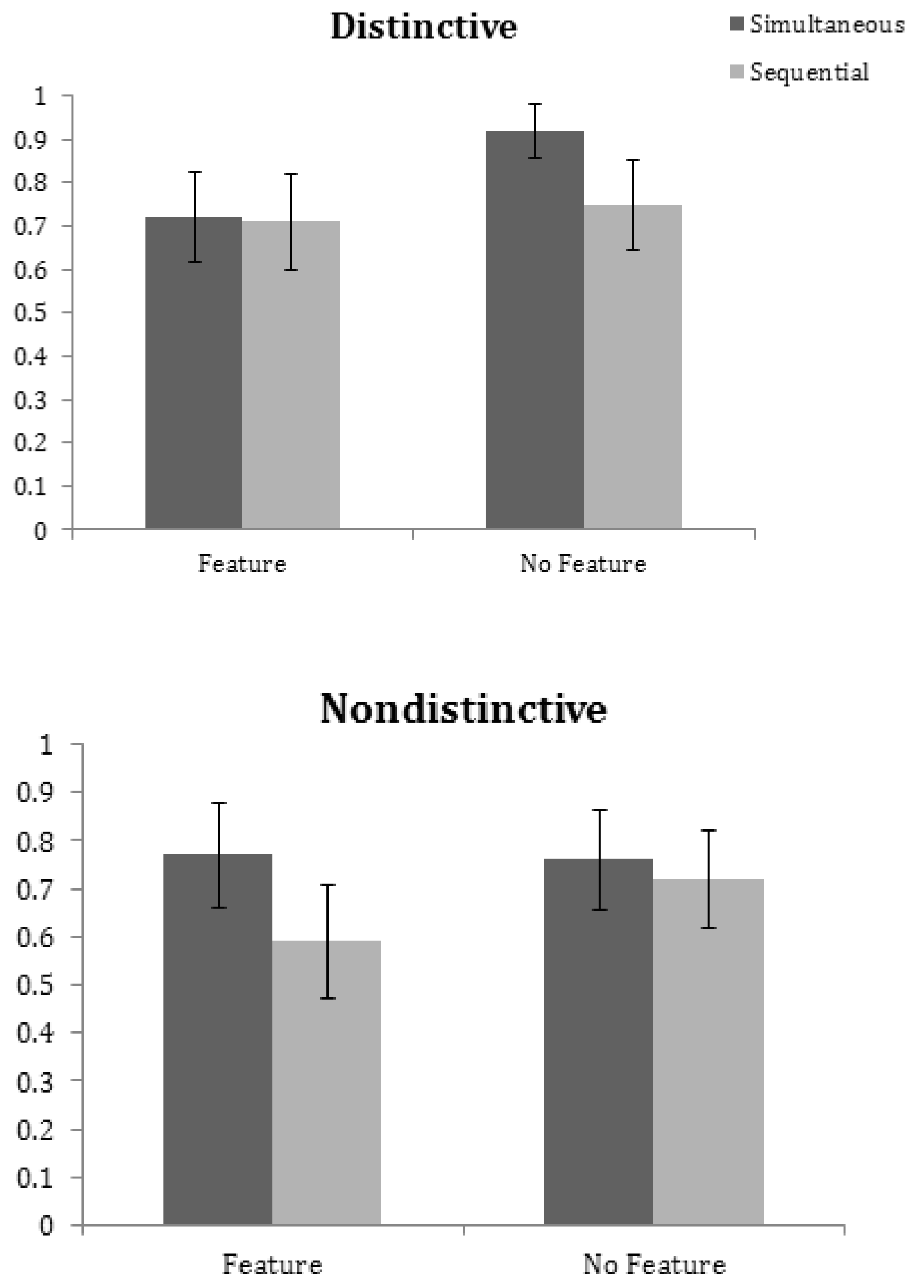

Figure 3. Correct identification rate (with 95% confidence error bars) for distinctive and nondistinctive faces.

Turning now to the false ID rates, participants were more likely to falsely identify an IR of a nondistinctive compared to a distinctive target, $F(1, 47) = 6.87$, $p = .01$, $\eta_p^2 = .13$. In addition, there was an interaction between an added feature and lineup presentation, $F(1, 47) = 4.47$, $p = .04$, $\eta_p^2 = .09$. Figure 4 illustrates this interaction, and pairwise comparisons revealed that false ID rate was highest (.26) when participants studied a nondistinctive target with an added feature, compared to when they studied a distinctive target without an added feature, and the IR was presented in a simultaneous lineup, $t(23) = 3.24$, $p = .004$, $d = 0.84$.

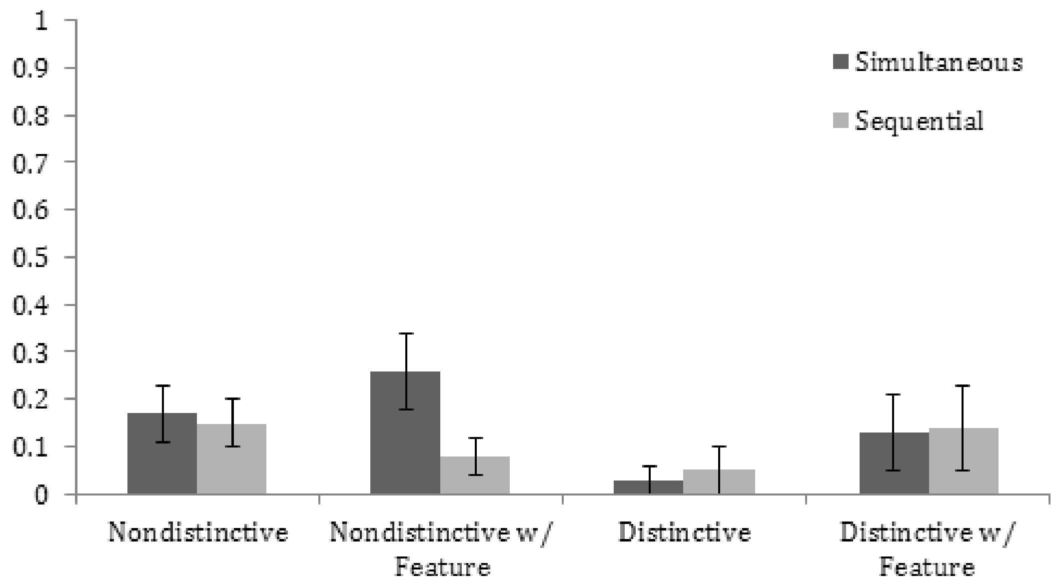

Figure 4. False identification rate (with 95% confidence error bars) across all conditions.

In terms of probative value (Figure 5), this high false ID rate for the simultaneous lineup created a single sequential lineup advantage among the four simultaneous-sequential comparisons, $t(98) = 2.11$, $p = .04$, $d = .43$. The sequential lineup was superior to the simultaneous lineup only when a feature was added to a nondistinctive target. Overall, distinctive targets without an added feature yielded the highest probative value, compared to: (a) distinctive targets with added feature, $t(99) = 2.34$, $p = .02$, $d = 0.47$; (b) nondistinctive targets, $t(99) = 3.14$, $p = .002$, $d = 0.63$; and (c) nondistinctive targets with added feature, $t(99) = 4.96$, $p < .001$, $d = 1.0$.

GENERAL DISCUSSION

Perpetrator distinctiveness could be an important factor to consider in the study of eyewitness identification. A comparison of holistic and feature-driven distinctiveness revealed that probative value was highest for distinctive targets without an added feature. Adding a feature to an already-distinctive face reduced correct ID rate (for the simultaneous lineup), but adding a feature to a nondistinctive face did not affect correct ID rate (for either simultaneous or sequential lineup). This could potentially have implications for police (and criminals): if for some reason a disguise is unfeasible, a criminal could simply apply an artificial facial feature, such as a temporary tattoo, to possibly reduce the likelihood that he will be chosen out of a lineup later, especially if he is placed in a simultaneous lineup. This also assumes that the feature is replicated across all foils, which is the current recommendation based on research (Zarkadi et al., 2009).

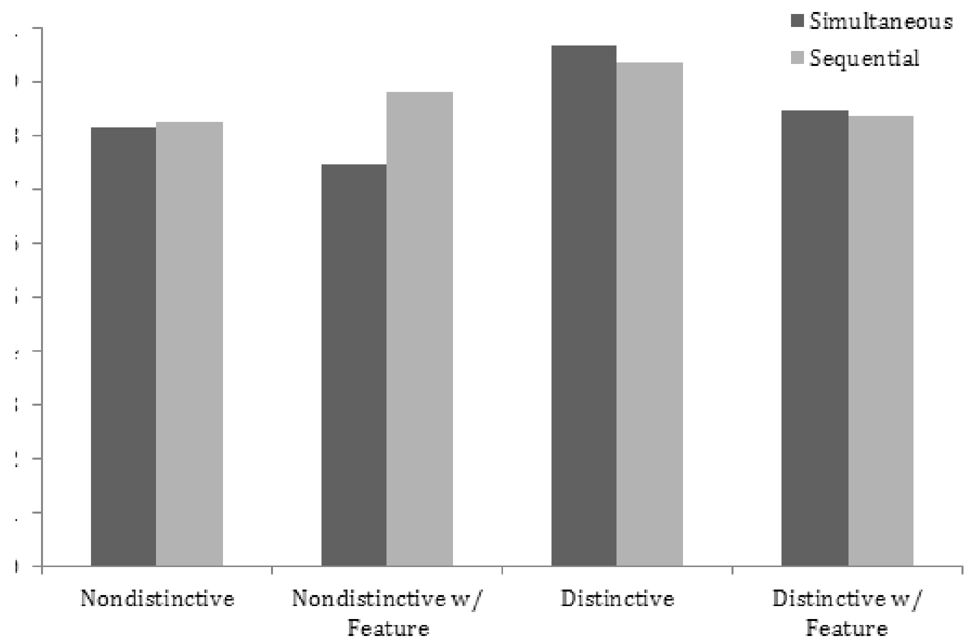

Figure 5. Probative value across all conditions, based on the conditional probability: correct ID rate/correct ID rate + false ID rate.

There also was an interaction between facial distinctiveness and the likelihood of a sequential lineup advantage. Out of four simultaneous-sequential comparisons, only one exhibited the "sequential superiority effect": when the target was nondistinctive but had an added feature. This finding expands upon recent work by Carlson and Gronlund (2011) that found a sequential advantage only for distinctive faces. The difference is that the locus of the present finding is the presence of a distinctive feature on an otherwise nondistinctive face, whereas their findings point toward distinctiveness more generally. However, they did not manipulate the presence of a distinctive feature. It should be noted that the faces of the present study (without an added feature) were the same as used by Carlson and Gronlund (2011), and the lineups were identical to the fair lineups used in their second experiment. The present results replicate theirs, with two exceptions, both in the distinctive face (no feature) condition: (a) higher correct ID rate (.92 compared to .81), and (b) lower false ID rate (.03 compared to .21) for the simultaneous lineup.

Why these discrepancies? Participants in the present study viewed, across trials, several faces with an added feature, and several without. The feature added to some of the faces might have distracted participants from any holistic distinctiveness of those faces. In support of this speculation, correct ID rates were lower (Figure 3) and false ID rates were higher (Figure 4) after adding a feature to a holistically distinctive face. Not only might the presence of an added feature have distracted participants, but not having a feature might have enhanced the saliency of the holistic distinctiveness of the faces, which had the dual effect of increasing correct ID rate and reducing false ID rate. Why would this only affect the simultaneous, and not the sequential lineup? If judgments from simultaneous lineups are made in a more relative manner (Lindsay & Wells, 1985) than the absolute nature of sequential lineup decisions, this would make the holistically-distinctive target stand out somewhat from even a fair lineup, therefore increasing correct ID rate. In other words, it is unlikely that the foils would mimic the idiosyncratic distinctiveness of the target. As for false ID rate, it already will be low in a sequential lineup if absolute judgments are based on recollection and distinctiveness (Carlson & Gronlund, 2011), but if the salience of the holistic distinctiveness of the target is emphasized by the lack of a distinctive feature (because participants have seen so many faces with such a feature across trials), this could allow a similar process to take place for the simultaneous lineup, therefore reducing false ID rate to the innocent replacement of the target.

The present study supports previous research showing that the sequential lineup advantage is not as robust as previously thought (Carlson & Gronlund, 2011; Carlson et al., 2008; Gronlund et al., 2009; Meissner et al., 2005). It was initially proposed (Ebbesen & Flowe, 2002) that the sequential lineup simply raised response criterion, therefore making not only false IDs, but also correct IDs, less likely compared to the simultaneous lineup. Meissner et al. (2005) found evidence for this claim. Gronlund et al. (2009) found just two sequential lineup advantages out of 24 simultaneous-sequential comparisons. Gronlund (2005) proposed that the likelihood of a sequential lineup advantage might involve distinctiveness of the target and the use of recollection. Carlson and Gronlund (2011) tested this theory, finding that the sequential advantage occurred only when recollection was used to retrieve distinctive details about the target, and that information was used to reject a TA lineup that did not contain those characteristics. This was the first evidence for a cognitive theory of the sequential lineup advantage, and the present study specified it further. The sequential lineup advantage could be based, at least in part, on the presence of a distinctive feature on the perpetrator's face. More research is needed to explore the interaction between holistic and feature-based distinctiveness and simultaneous versus sequential lineup performance. Also, following the recommendation of Lindsay et al. (2009), more research is needed to determine whether the sequential lineup advantage might be influenced by the overall strength of an eyewitness' memory of the perpetrator. Distinctiveness is only one way of determining memory strength, and future research should explore other avenues while comparing simultaneous and sequential lineups.

One weakness of the present study is the artificial nature of the lineup recognition paradigm used. It was used as a vehicle for presenting tightly controlled stimuli and those with highly specified manipulations (e.g., distinctive feature, fair lineup). Also, it allowed for the collection of 12 data points per participant rather than just one, as is typical of most eyewitness identification experiments, which is advantageous for theory testing. Clearly there is a large difference between an eyewitness to a real crime and presenting faces on a computer screen in a safe laboratory environment. However, performance across most conditions was far from floor or ceiling, indicating that the task was not too easy or difficult. Distracting stimuli were instituted during encoding and between encoding and retrieval in order to mimic real world characteristics. Also, the present findings expand upon those of another study (Carlson & Gronlund, 2011) and agree with studies that used more realistic stimuli and procedures (Carlson et al., 2008; Gronlund et al., 2009) in finding few if any sequential lineup advantages. In addition, Meissner et al. (2005) used a similar lineup recognition paradigm to compare simultaneous and sequential lineups, and Zarkadi et al. (2009) used an artificial face recognition paradigm to study the effect of distinctive facial features on eyewitness identification. In testing basic memory findings in an applied domain, it is important to first do so with many of the same controls as used in the basic literature to maintain internal validity. The next step is to replicate these findings with more realistic eyewitness identification scenarios (e.g., mock crime, a longer retention interval) to support external validity.

Conclusions and Implications

Perpetrator distinctiveness is a potentially important factor in predicting eyewitness accuracy, yet it has been largely neglected in the literature. The present study focused on holistic versus feature-based distinctiveness and effects on simultaneous versus sequential lineups, but several of the Biggers criteria (*Neil v. Biggers*, 1972) established in U.S. law for assessing the utility of eyewitness evidence also are relevant to the issue of perpetrator distinctiveness. One criterion is the witness's degree of attention, which would be drawn more to a distinctive than a nondistinctive face (Ryu & Chaudhuri, 2007). Another is the eyewitness' confidence, and facial distinctiveness has been shown to influence the confidence-accuracy correlation (Brigham, 1990). Finally, another criterion is the accuracy of the description of the perpetrator provided by the eyewitness, and research shows that distinctive faces are easier to describe and lead to a modest relationship between description quality and recognition accuracy (Wells, 1985). If a description includes one or more distinctive features, police could anticipate the potentially beneficial use of a sequential lineup. However, the present findings, as well as those by Carlson and Gronlund (2011), indicate that if a perpetrator is not particularly distinctive, either a simultaneous or a sequential lineup could be sufficient. Further research is needed to explore the various influences of distinctiveness on eyewitness memory, as well as other manipulations of memory strength and their potential effects on the likelihood of a sequential lineup advantage.

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ENDNOTE

1. According to Hunt (2003), distinctiveness is defined not by an item in isolation, but rather as a difference within some context of item similarity. Therefore, in the present study the distractor faces presented at encoding were chosen because they did not appear particularly distinctive and they also had no obvious distinctive feature(s). This should have served to make the holistically distinctive targets, and those with an added feature, more salient against this background of nondistinctive faces.

APPENDIX

Description of stimuli selection and preparation process from Carlson & Gronlund (2011), mostly copied verbatim (stimuli used with permission)

Selection of faces and distinctiveness ratings.

The Florida Department of Correction database as used to select 100 faces. Only Caucasian males between the age of 20 and 40 that appeared to be especially distinctive or nondistinctive were chosen. A group of students (N = 69) rated each face on a 1-7 Likert scale of distinctiveness. We narrowed-down to the 20 most distinctive (M = 5.41, SD = .47) and 20 most nondistinctive (M = 3.27, SD = .12) faces, and these two groups differed significantly on distinctiveness, $t(19) = 19.59$, $p < .001$, $d = 6.24$.

Selection of targets and innocent replacements.

A new group of participants (N = 63) rated every pairwise comparison of faces from the nondistinctive pool on a 1-7 Likert scale of similarity. Ten pairs with the highest rated similarity (M = 4.73) were divided: one member of each pair became a target and its partner became the replacement. The distinctive faces were too varied for this same procedure to yield enough pairs that were rated as highly similar. Therefore, several additional faces that specifically looked like each distinctive face were downloaded from the prison database and another independent group of participants (N = 85) rated each possible pair in terms of similarity. The 10 pairs rated highest in similarity (M = 4.62) became target-replacement pairs.

Selection of foils for fair lineups.

We used the second through 11th most similar faces to each distinctive target and divided them randomly into TA and TP lineups. Therefore these foils were matched to the suspect (Tunnicliff & Clark, 2000). Another group of participants (*N* = 64) searched the database for faces that were similar to each nondistinctive face, and these faces were used to create suspect-matched fair lineups for the nondistinctive targets and innocent replacements.

Lineup fairness.

In order to establish that we had a set of fair lineups, we followed procedures set out by Malpass (1981), as follows. Two research assistants agreed upon a basic description for each distinctive target, distinctive replacement, nondistinctive target, and nondistinctive replacement (e.g., Caucasian male in his 30's, average weight, shaved head, brown eyes). An independent group of participants (*N* = 102) read each description prior to presentation of the appropriate lineup. Their task was to select the person from each lineup that best matched the description. We used this information to compute lineup fairness in terms of Tredoux's *E'* (Tredoux, 1998), which ranges from 1 to *k* where *k* is the nominal lineup size and roughly corresponds to the number of reasonable choices in a lineup. As more lineup members are chosen less often than expected by chance, *E'* will approach 1, signifying a biased lineup. A lineup is fairer as *E'* approaches *k*. Based on the distribution of responses across all lineups, we narrowed down to 12 fair lineups (Tredoux's *E'* = 4.02, *SD* = .63) consisting of three distinctive target-present, three distinctive target-absent, three nondistinctive target-present, and three nondistinctive target-absent. Tredoux's *E'* did not differ between fair lineups built for distinctive faces (*M* = 4.01) and fair lineups built for nondistinctive faces (*M* = 4.03).

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